IS 4639-6 (2002): Petroleum Industry - Terminology, Part 6: Meaurement [PCD 3: Petroleum, Lubricants and their Related Products]

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भारतीय मानक

पेट्रोलियम उद्योग — शब्दावली

भाग 6 मापन

(पहला पुनरीक्षण)

Indian Standard

PETROLEUM INDUSTRY — TERMINOLOGY

PART 6 MEASUREMENT

(First Revision)

ICS 10.040.75;75.080

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Price Group 10

NATIONAL FOREWORD

This Indian Standard (Part 6) (First Revision) which is identical with ISO 1998-6 : 2000 'Petroleum industry — Terminology — Part 6 : Measurement' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of Petroleum Products Sectional Committee and approval of the Petroleum, Coal and Related Products Division Council.

This standard was published in 1968 with a view to eliminate the ambiguity arising from different interpretations of terms used in petroleum trade and industry, and to establish a generally recognized terms. Since the industry has progressed manifolds over the years, a need was felt to bring in newer terms. The Committee, therefore, decided to revise this standard to completely align with ISO 1998-6 : 2000 under the dual numbering system. Accordingly, the title has been changed as 'Petroleum industry — Terminology : Part 6 Measurement'.

It is envisaged to issue this standard in different parts, each dealing with a specific aspect. The other parts in this series are as under:

Part 1 Raw materials and products

Part 2 Properties and tests

Part 3 Exploration and production

Part 4 Refining

Part 5 Transport, storage, distribution

Part 7 Miscellaneous terms

Part 99 General and index

The English version of the text of ISO Standard has been retained without deviations for publication as Indian Standard. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

For tropical countries like India, the standard temperature and the relative humidity shall be taken as 27 ± 2°C and 65 ± 5 percent respectively.

Indian Standard

PETROLEUM INDUSTRY — TERMINOLOGY

PART 6 MEASUREMENT

(First Revision)

1 Scope

This part of ISO 1998 introduces a list of equivalent English and French terms, in use in the petroleum industry to indicate the measurement of crude oils and petroleum products, together with the corresponding definitions in the two languages.

ISO 1998 is intended to cover the purposes of this part of petroleum industry dealing with crude oils and petroleum products, that means all related operations arising from the production field to the final user. It is not intended to cover either petroleum equipment, or any operation in the field. However some pieces of equipment or some operations of exploration and production are defined. The corresponding terms were introduced only when they appear in a definition of a product or process and when their definition was found necessary for understanding or for avoiding any ambiguity. Where a terminology of petroleum equipment is needed, it corresponds to the scope of ISO/TC 67 *Materials, equipment and offshore structures for petroleum and natural gas industries.*

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of ISO 1998. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 1998 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1998-99:2000, Petroleum industry — Terminology — Part 99: General and index.

3 Term numbering

The general classification and numbering system used in ISO 1998 employs digits grouped in three categories:

x.yy.zzz

where

x is the part number of ISO 1998, in this case Part 6;

yy is the subcategory in which the term appears. Part 6 has seven subcategories:

- 10 static measurement
- 20 dynamic measurement
- 30 statistical analysis of measurement
- 40 sampling
- 50 properties and instrumentation
- 60 calibration and standards
- 99 acronyms

zzz is the serial number of the individual term.

4 Index

See ISO 1998-99.

5 Order of listing

Terms are listed in serial number order.

6 Bibliography

Several definitions in this part of ISO 1998 are taken from the following standards.

ISO 4006:1991, *Measurement of fluid flow in closed conduits — Vocabulary and symbols.*

ISO 4259:1992, *Petroleum products — Determination and application of precision data in relation to methods of test.*

OIML R 117:1995, *Measuring systems for liquids other than water.*

VIM:1993, *International vocabulary of basic and general terms in metrology.*

However, some definitions in this part of ISO 1998 may differ from the definitions contained in VIM ; they are then indicated by the mention "adapted from VIM".

The definitions in this part of ISO 1998 relate solely to common usage in the petroleum industry. They are not intended to take precedence over VIM definitions, especially in applications where the latter may have legal standing.

6.10 Static measurement

6.10.019
calibrated volume
volume of a proving tank between the "empty" and "full" conditions when operated according to the conditions specified on its calibration certificate

6.10.025
bottom calibration
determination of the partial capacities of the lower portions of a tank

6.10.032
calibration table
tank capacity table
tank table
capacity table
table, often referred to as a calibration table, a tank table or tank capacity table, showing the capacities of, or volumes in, a tank corresponding to various liquid levels measured from a reference point

6.10.033
capacity
total volume of a tank

6.10.046
critical zone
level range, close to the bottom of a floating roof tank, in which there are complex interactions and effects as the floating roof comes to rest on its legs

NOTE The zone is usually clearly marked on tank capacity tables. Measurements for custody transfer purposes should not be made within it.

6.10.047
critical zone height
upper limit of the critical zone

NOTE This term can also be defined as the level at which one or more of the floating roof or floating blanket legs first touch the tank bottom.

6.10.049
datum point
position used as the datum in the preparation of a calibration table

NOTE This position may differ from the **gauge reference point** (5.20.215).

cf. **reference point** (6.10.217)

6.10.050
deadwood
any tank fitting which affects the capacity of a tank

6.10.051
positive deadwood
fitting whose capacity adds to the effective capacity of the tank

6.10.052
negative deadwood
fitting whose volume displaces liquid and reduces the effective capacity of the tank

6.10.059
dip
innage
depth of a liquid in a tank

6.10.060
dip point
point on the dip-plate which the dip-weight touches during gauging and from which the measurements of the oil and water depths are taken

NOTE The dip point usually corresponds with the datum-point, but when this is not so the difference in level between the datum-point and the dip point has to be allowed for in the calibration table [see **dip-plate** (5.20.213)].

6.10.061
dipped volume
observed volume of material calculated to be contained within a tank using the dip and tank calibration table

6.10.075
equivalent dip
depth of liquid in a tank corresponding to a given ullage

6.10.080
floating mark
mark apparently occupying a position in the three-dimensional space formed by a stereoscopic fusion of a pair of photographs and used as a reference mark in examining or measuring the stereoscopic model

6.10.081
floating-roof mass
total mass of a floating roof, inclusive of any extra load on it

NOTE The mass of the floating roof may be increased by extraneous matter, such as rainwater, snow or debris, which should be taken into account.

6.10.084
free water
water that exists as a separate layer within a tank

NOTE It typically lies beneath the oil.

6.10.085
free water level
level of water that exists as a separate layer within the tank

NOTE The volume corresponding to the level will include the volume of any deposited sediment that may be present.

6.10.095
gauging
process of taking all the necessary measurements in a tank in order to determine the quantity of liquid which it contains

NOTE In the French language, the term "jaugeage" also covers all the measurement operations made to measure the tank capacity up to one or several level(s).

6.10.100
gross observed volume
volume of oil including dissolved water, suspended water and suspended sediment but excluding free water and bottom sediment, measured at the oil temperature and pressure prevailing

NOTE 1 This may be either the volume in a tank or the difference between the volumes before and after a transfer.

NOTE 2 The acronym GOV is generally used rather than the full term.

6.10.101
net observed volume
volume of oil excluding total water and total sediment measured at the oil temperature and pressure prevailing

NOTE 1 This may be either the volume in a tank or the difference between the volumes before and after a transfer.

NOTE 2 The acronym NOV is generally used rather than the full term.

6.10.103
gross standard volume
volume of oil including dissolved water, suspended water and suspended sediment but excluding free water and bottom sediment, calculated at standard conditions

NOTE 1 This may be either the volume in a tank or the difference between the volumes before and after a transfer.

NOTE 2 The acronym GSV is generally used rather than the full term.

6.10.104
net standard volume
volume of petroleum liquids, excluding sediment and water, corrected to standard conditions of temperature and pressure

NOTE 1 This may be either the volume in a tank or the difference between the volumes before and after a transfer.

NOTE 2 The acronym NSV is generally used rather than the full term.

6.10.112
HTG reference point
stable reference point from which the HTG sensor positions are measured

6.10.113
hydrostatic tank gauging
method of direct measurement of liquid mass in a storage tank based on measuring static pressures caused by the liquid head above the pressure sensor

NOTE The acronyms HTG is often used rather than the full term.

6.10.121
inner orientation
process of determining, mathematically, the interior perspective of the photographs at the time of exposure in an analytical stereoplotter

NOTE The calibrated focal length, the location of the calibrated principal point and the calibrated lens distortion are the principal factors used in the calculation.

6.10.130
latitude
horizontal circumference on the surface of a sphere

6.10.131
longitude
circumference on the surface of a sphere passing through the north and south poles

6.10.132
equator
largest horizontal circumference of a spherical tank

6.10.140
liquid level
distance between the surface of the liquid in a tank and the gauge reference point, measured by dipping or ullaging along the centreline of the dip hatch

NOTE When a ship is in a list or trim condition, the height measured by the gauge may be vertical or at right angles to the task bottom, depending on the type of gauging equipment used.

6.10.142
Littlejohn grip
quick-release clamp and handle attachment that is fitted around a strapping tape, enabling it to be pulled to the correct tension

6.10.148
longitudinal line
line formed by a longitudinal plane crossing a horizontal plane

6.10.149
longitudinal plane
vertical plane running parallel to the centreline of the tank

6.10.153
measurement ticket
written acknowledgement of the receipt or delivery of a quantity of crude oil or petroleum product, including a record of the measurement data

NOTE It may be a form to be completed, a data print out or a data display depending on the degree of automation, remote control, or computerization, previously described as "run ticket" and "receipt and delivery ticket".

6.10.154
measuring line
line (longitudinal, transverse or vertical) on a three-dimensional rectangular grid with a pitch not greater than 5 m

NOTE Measurement for calibration purposes is taken along these measuring lines.

6.10.160
north pole
zenith, or highest point of a spherical tank shell, an imaginary point in most spherical tanks due to the pipe tower or other appurtenances

6.10.161
south pole
nadir, or lowest point of a spherical tank

6.10.170
open capacity
calculated capacity of a tank or part of a tank before any allowance has been made for deadwood

6.10.183
pin-height
lower limit of the critical zone ; the level at which the floating roof or floating cover rests fully on its legs

6.10.194
product heel mass
mass of product below the bottom HTG (6.99.050) sensor

6.10.195
product heel volume
observed volume of product below the bottom HTG (6.99.050) sensor, calculated by subtracting the water volume from the total heel volume

6.10.209
referee method of tank calibration
application of the strapping method of tank calibration to give an accurate calibration of a tank for custody transfer purposes or to provide a basis for assessing the accuracy of other methods of tank calibration

6.10.210
reference datum of high pressure tank
reference point located above the isolation valve of an automatic gauge in a pressure vessel and used to check the gauge calibration

NOTE This point may be in the level-gauge glass.

6.10.212
reference height
distance between the dip datum point and the upper reference point

6.10.213
reference line
vertical line established, by means of an optical reference line device, at predetermined positions around a vertical cylindrical tank from which offset measurements are made when calibrating a tank using the optical reference line method

6.10.215
offset
horizontal measurements made from a reference line to the tank wall when calibrating a tank using the optical reference line method

NOTE 1 Reference offsets are offset measurements made from the reference line to the tank wall at the height of the reference circumference measurement.

NOTE 2 The term is also used in ship tank calibration where an offset is a measurement taken from a horizontal line parallel to the tank wall.

6.10.216
reference plane
plane parallel to a side wall, end wall or tank bottom which passes through a reference line

NOTE This term applies to the calibration of ships' tanks.

6.10.217
reference point
point to which all measurements subsequent to calibration are related

6.10.219
reference target point
fixed point clearly marked on the inside surface of the tank shell wall

6.10.220
tank-calibration reference temperature
temperature at which the calibration of a tank has been calculated

6.10.223
relative orientation
process of determining the relative position and attitude of a pair of overlapping photographs by mathematical analysis to create a stereoscopic model

6.10.252
section line
line formed by a section plane crossing a horizontal plane

6.10.253
section plane
plane parallel with the fore and aft end walls of a ship's tank

6.10.260
slope distance
distance measured from the electro-optical distance ranging instrument to a target point on any given course of the tank shell wall

6.10.269
step-over
device used in strapping for measuring the distance apart along the arc of two points on a tank shell where it is not possible to use a strapping tape directly because of an intervening obstruction, e.g. a protruding fitting

6.10.270
step-over constant
distance between the measuring points of a step-over as measured along the arc of the particular course of the tank concerned

6.10.271
step-over correction
difference between the apparent distance between two points on a tank shell as measured by a strapping tape passing over an obstruction and the true arc distance as measured by a step-over, i.e. the step-over constant

6.10.272
stereoscopic model
three-dimensional model formed by intersecting homologous rays of a pair of overlapping photographs

6.10.273
stereoscopic photograph
set of photographs of an object taken from two different positions so that they may form a stereoscopic model of the object depicting it as if it were in three-dimensional space

6.10.275
strapping method
method of tank calibration in which the capacities are calculated from the measurement of the external circumferences, due allowance being made for the thickness of the shell of the tank

6.10.276
strapping tape
specially designed and calibrated steel measuring tape graduated in units of length and used for taking circumferential measurements in tank calibration

6.10.283
suspended water
water contained within the oil that is finely dispersed as small droplets

NOTE It may, over a period of time, either collect as free water or become dissolved water, depending on the conditions of temperature and pressure prevailing.

6.10.293
target
predetermined position distinctively marked on the inside surface of the tank for the stereophotogrammetry

6.10.294
target point
one of a series of points on the inside surface of the tank shell wall to which slope distance, vertical and horizontal angles are measured

6.10.301
total calculated volume
gross standard volume plus the free water measured at the temperature and pressure prevailing

NOTE The acronym TCV is generally used rather than the full term.

6.10.302
total observed volume
volume of oil including total water and total sediment, measured at the oil temperature and pressure prevailing

NOTE 1 This may be either the volume in a tank or the difference between the volumes before and after a transfer.

NOTE 2 The acronym TOV is generally used rather than the full term.

6.10.304
total standard volume
total volume at standard temperature and pressure

NOTE The acronym TSV is generally used rather than the full term.

6.10.306
total water
the sum of all the dissolved, suspended and free water in a cargo or parcel of oil

6.10.307
traverse point
position on the inside surface of the tank above which a theodolite is set for determining the coordinates of a target

6.10.309
ullage
outage
distance between the surface of a liquid in a tank and a fixed reference point on the top of the tank

NOTE The term can also describe the capacity of a tank not occupied by the liquid.

6.10.312
ullage pressure
pressure in the ullage space of the tank

6.10.313
ullage volume
volume of the ullage space in a tank, obtained by subtracting the liquid volume from total tank capacity

6.10.314
ullage reference point
point clearly marked on the dip-hatch, or on a plate suitably located above or below the dip-hatch, and situated above the maximum level in the tank to indicate the point from which measurements of ullage are taken

6.10.315
upper reference point
point clearly defined on the dip-hatch directly above the dip-point to indicate the position at which dipping or ullaging shall be carried out

6.10.321
vertical line
line formed by a section plane on the side walls and formed by a longitudinal plane on the fore and aft end walls

6.10.329
water bottom
layer of water at the bottom of a tank, of such depth as to completely cover the bottom

6.10.330
water cut
water dip
⟨static measurement⟩ level or volume of free water in a tank

6.10.334
working method of tank calibration
application of the strapping method of tank calibration by a simplified procedure that may result in some loss of accuracy and is unsuitable for assessing other methods

6.10.400
clingage
⟨static measurement⟩ material which adheres to the surfaces of tank walls and structures, both horizontal and vertical, within empty or part-empty tanks other than bottom surfaces

NOTE In French, the English term "clingage" is often used.

6.10.410
on-board quantity
sum of liquid volume and non-liquid volume in cargo tanks just before loading, excluding clingage, hydrocarbon vapours and the content of associated pipelines and pumps

NOTE The acronym OBQ is generally used rather than the full term.

6.10.411
quantity remaining on board
sum of liquid volume and non-liquid volume in cargo tanks just after discharge has been completed, excluding clingage, hydrocarbon vapours and the contents of associated pipelines and pumps

NOTE The acronym ROB is generally used rather than the full term.

6.10.416
liquid volume
measurable amount of material which is free-flowing at the time of measurement

NOTE The material can be oil or free water, or both.

6.10.417
non-liquid volume
measurable amount of material which is not free-flowing at the time of measurement

NOTE It can include any one or a combination of hydrocarbon waxes, water/oil emulsions, inorganic materials, or solidified cargo.

6.10.433
wedge formula
mathematical means to assess small quantities of measurable liquid and/or non-liquid material which is in a wedge configuration and does not touch all bulkheads of the vessel's tank

NOTE The formula is based on the characteristics of cargo compartments, vessel trim and the depth of the material.

6.10.434
wedge table
vessel's cargo-tank volume table based on compartment characteristics for use when the cargo does not touch all bulkheads of the tanks

6.10.440
bottom sediment
mixture of non-hydrocarbon solids present in a tank as a separate layer at the bottom

6.10.441
suspended sediment
non-hydrocarbon solids present within the oil, but not in solution

6.10.442
total sediment
sum of suspended and bottom sediment

6.20 Dynamic measurement

6.20.010
metering conditions
conditions of the liquid of which the volume is to be measured, at the point of measurement

NOTE Example: temperature and pressure of the measured liquid.

[OIML R 117:1995]

6.20.040
clingage
⟨dynamic measurement⟩ liquid film that adheres to the inside surface of a volumetric or prover tank after it has been emptied

6.20.050
water cut
water dip
⟨dynamic measurement⟩ volume of free water passing through a pipeline

6.20.090
base volume
calibrated volume of a pipe prover at reference conditions of temperature and pressure

6.20.100
proving in dynamic measurement
technique whereby a meter factor or *k*-factor is established, using a volumetric or gravimetric prover

6.20.101
on-line proving
process where a meter is proved on-line under the same flow conditions and with the same products as occur during the throughput

6.20.102
central proving
process where a meter is proved in a laboratory on products of varying viscosity and over a range of flowrates

NOTE An equation, determined by means of a polynomial, is often applied to predict the meter or *k*-factor for various viscosities and flowrates.

6.20.105
pipe prover
meter-proving device consisting of a section of pipe in series with the meter and through which the liquid flows during the proving run

NOTE 1 The pipe is constructed to close tolerances and contains a displacer which sweeps an accurately determinable volume of liquid between the detectors.

NOTE 2 Pipe provers are divided into two types : conventional pipe provers or small volume provers.

6.20.106
bi-directional prover
pipe prover designed to enable proving runs to be made in both directions alternately

6.20.107
small volume prover
pipe prover consisting of a honed cylinder, with a piston rod whose linear movement is measured by external (non-invasive) detectors

NOTE They are typically of smaller dimensions than the equivalent conventional pipe prover.

6.20.109
flashing
formation of vapour when the local pressure at a point within the liquid falls below the saturated pressure of the liquid at the operating temperature

6.20.110
cavitation
phenomenon following flashing where the pressure recovers above the vapour pressure and the vapour bubbles collapse

6.20.115
control chart
graphical technique of statistical control in which measurements are plotted against time in order to assist in the monitoring of ongoing measurements

6.20.116
Shewhart chart
chart (first developed by Walter A. Shewhart) on which limits are drawn and values of a variable plotted and monitored

NOTE If the values lie within the chosen limits then the system can be considered to be in control. A learning period involving at least 10 consecutive results is required in order to establish the control limits. The confidence limits chosen are based on a probability of 95 % or 99 %.

6.20.117
cumulative-sum chart
cusum chart
control chart on which are plotted accumulated values of the variable

NOTE Straight lines are fitted to the points; where changes in slope of the fitted lined occur, they indicate the possible occurrence of "events" which may merit investigation.

6.20.119
moving average chart
control chart, often used to monitor any long-term drift in meter factor readings, on which are plotted the averages of successive measurements

NOTE The average is usually based on either five consecutive readings or ten. The first reading is dropped and a new reading incorporated in the moving average.

6.20.120
control limits
limits applied to a control chart to establish whether the scatter of the data is due entirely to random influences

NOTE When associated with 95 % confidence levels, they are termed "inner" or "warning" limits (if all the data lie within these limits then the measurement system can be said to be in control). When associated with 99 % confidence levels, they are termed "outer" or "action" limits and are used to detect any outliers which may indicate that the measurement system is out of control.

6.20.125
Coriolis meter
flowmeter which uses the interaction between the mass flow of the fluid and the oscillations of the vibrating conduits for mass flowmetering purposes

NOTE The Coriolis meter can also be used as a **continuous density meter** (6.50.021).

6.20.126
direct mass meter
self-contained integrating measuring device which measures continuously the mass of fluid passing through it, using a process in which signals generated in proportion to the mass flow rate are detected and converted to a mass flow measurement signal

6.20.127
displacement meter
meter which measures the volume flowing in a closed conduit by dividing it into discrete quantities by means of a close-fitting or semi-rotary assembly in the meter body

NOTE The quantity passing through the meter is a function of the number of operating cycles of the assembly.

6.20.128
reference meter
flowmeter employed to prove other flowmeters

NOTE This meter is usually proved over a range of flowrates and on products of varying viscosity in order to derive a number of corrections which can be applied to bring meter readings to standard conditions.

6.20.130
turbine meter
meter which provides a pulsed output at a frequency proportional to the angular velocity of a bladed rotor mounted in the meter body and driven by the fluid flow

NOTE The output is proportional to the volumetric flowrate of the fluid.

6.20.131
vortex-shedding meter
flowmeter which comprises a bluff body from which a succession of vortices are shed alternately on each side of the bluff body

NOTE For a given range of flowrate, the frequency at which the vortices are shed is directly proportional to the flowrate and can be counted using a wide variety of sensors.

6.20.135
linearity of meter
maximum and minimum limits of k-factor, meter factor or error within which the calibration curve fits over a stated flow range

6.20.136
turndown ratio of a meter
effective flow range over which the meter factor is linear

6.20.137
indicated volume
change in meter reading that occurs during a transfer through the meter

6.20.138
gross volume
indicated volume multiplied by the meter factor appropriate to the liquid and flowrate, without correction for temperature and pressure

6.20.141
***k*-factor**
number of pulses generated by a meter while a unit of volume is passing through it

6.20.142
meter factor
ratio of the actual volume of liquid passed through a meter to the volume indicated by it

NOTE 1 In practice this is the prover volume divided by the meter reading, each corrected to common conditions.

NOTE 2 This term can also be defined as the ratio of the *k*-factor obtained on proving a meter to the original or nominal (maker's figure) *k*-factor.

6.20.143
scaling factor
numerical factor which converts the pulse count of a meter to the required units of volume

6.20.145
curve fit
technique of fitting a curve to a number of meter factors or *k*-factors

NOTE A polynomial or the following types of curve are usually employed:

linear	$(y = ax + b)$
logarithmic	$(y = a + b \ln x)$
exponential	$(y = ab^x)$
power	$(y = ax^b)$

6.20.150
cyclic distortion
any periodic variation in the frequency generated by a meter, that may be caused by mechanical asymmetry within the meter or by the addition of accessories such as temperature compensators.

6.20.151
intra-rotational linearity
quantitative measure of the degree of regularity of spacing between the pulses produced by a rotating meter at constant flowrate

NOTE This is generally expressed as the standard deviation of pulse spacing about the mean pulse spacing. This measure will include cyclic and non-cyclic measurements introduced by the meter mechanism.

6.20.155
detector of a prover
devices that sense precisely, by direct or indirect means, the position of the displacer at each end of the prover's calibrated volume

NOTE For small-volume provers the detectors are usually mounted externally for measuring the distance travelled by the piston rod connected to the internal displacer.

6.20.170
electronic head
electronic device fitted to a flowmeter that has realtime data-processing capability and enables correction factors to be applied continuously to the meter output registered by the device

6.20.180
flying start and stop
procedure which involves obtaining the opening and closing meter readings of the proof whilst the meter is in operation

6.20.181
standing-start-and-stop
proving technique in which the flow through the meter and the proving device is started at the beginning and stopped at the end of the proving process

6.20.185
flow conditioning
general term describing methods for eliminating the effect of irregular velocity distribution (swirl) in the pipework upstream of the meter

6.20.186
flow conditioner
device inserted in a conduit to reduce the straight length needed to obtain a regular velocity distribution

6.20.190
gating
initiation and cessation of pulse totalization in a counter, e.g. by pipe prover detectors

6.20.195
launch/receive chamber
enlarged section at each end of a bi-directional pipe prover and in which the displacer rests between proving runs

6.20.205
pass
one single movement of the displacer between two detectors in a pipe prover

6.20.215
pulse interpolation
electronic technique for enhancing the resolution of a gated pulse count

6.20.216
pulse interpolation divisor
ratio of the enhanced pulse frequency of the pulses generated by the meter, used in the phase-locked-loop system of pulse interpolation

6.20.235
round-trip volume
sum of the swept volumes in both the forward and reverse directions in a bi-directional prover

6.20.240
run
set of consecutive passes that is in any particular case deemed to be necessary to derive a single value of meter factor or *k*-factor suitable for reporting

6.20.260
swirl
condition of flow in which the liquid flowing through the pipework upstream of a meter rotates and fluctuates in velocity relative to the average flowrate

NOTE Flow conditioning is one method employed to eliminate this undesirable effect.

6.20.270
totalizer
mechanical or electronic device for integrating and displaying the throughput of a flowmeter

6.20.285
displacer in a pipe
sphere or piston which sweeps out the calibrated volume of a pipe prover

6.30 Statistical analysis of measurement

6.30.001
error
difference between a computed or measured quantity and the true value

6.30.002
absolute error
term sometimes used when it is necessary to distinguish error from relative error

NOTE This should not be confused with absolute value of error, which is the modulus of the error.

6.30.003
relative error
error of measurement divided by the true value of the measurand

NOTE Since the true value cannot be determined, in practice a conventional true value is used.

[Adapted from VIM 1993: 3-12]

6.30.004
random error
result of a measurement minus the mean that would result from an infinite number of measurements of the same measurand carried out under repeatability conditions

NOTE 1 Random error is equal to error minus systematic error.

NOTE 2 Because only a finite number of measurements can be made, it is possible to determine only an estimate of random error.

[VIM 1993: 3-13]

6.30.005
systematic error
mean that would result from an infinite number of measurements of the same measurand carried out under repeatability conditions minus the true value of the measurand

NOTE 1 Systematic error is equal to error minus random error.

NOTE 2 Like true value, systematic error and its causes cannot be completely known.

[Adapted from VIM 1993: 3-14]

6.30.006
spurious error
error which invalidates a measurement

NOTE It generally has a single cause such as the incorrect recording of one or more significant digits or the malfunction of instruments.

6.30.007
overall error
error composed of error factors with respect to mechanical parts, data transmissions, local indicator and/or remote indicator, but does not include other error factors related to installation and deformation of the tank

6.30.008
maximum permissible error
extreme value of error permitted by regulations appertaining to that system

6.30.009
short-term meter error
scatter of meter factors or k-factors obtained when proving a meter

NOTE The scatter can either be expressed as the range of the consecutive readings (maximum – minimum) over a short period of time i.e. minutes, or as the random uncertainty expressed as $U = t_{95,n-1}s(x)$, where t is the Student's t-value for a probability of 95 % and $s(x)$ is the observed standard deviation.

6.30.010
long-term meter error
scatter of the means of sets of meter factors, carried out over intervals of time, i.e. days, weeks, months, etc.

NOTE $U = t_{95,n-1}s(z)$, where $s(z)$ is the standard deviation of the mean meter-factor values.

6.30.015
accuracy of a measuring instrument
ability of a measuring instrument to give responses close to the true value

NOTE "Accuracy" is a qualitative concept.

[Adapted from VIM 1993: 5-18]

6.30.016
repeatability of results of measurements
closeness of the agreement between the results of successive measurements of the same measurand carried out under the same conditions of measurement

NOTE 1 These conditions are called repeatability conditions.

NOTE 2 Repeatability conditions include

- the same measurement procedure;
- the same observer;
- the same measuring instrument, used under the same conditions;
- the same location;
- repetition over a short period of time.

NOTE 3 Repeatability may be expressed quantitatively in terms of the dispersion characteristics of the results.

[VIM 1993: 3-6]

6.30.017
reproducibility of results of measurements
closeness of the agreement between the results of measurements of the same measurand carried out under changed conditions of measurement

NOTE 1 A valid statement of reproducibility requires specification of the conditions changed.

NOTE 2 The changed conditions may include

- principle of measurement;
- method of measurement;
- observer;
- measuring instrument;
- reference standard;
- location;
- conditions of use;
- time.

NOTE 3 The reproducibility may be expressed quantitatively in terms of the dispersion characteristics of the results.

NOTE 4 The results considered here are usually understood to be corrected results.

[VIM 1993:3-7]

NOTE 5 Not usually applicable to bulk quantity measurement.

6.30.020
uncertainty
$U( )$
estimate characterizing the range of values within which the true value of a measurand lies

NOTE 1 The symbol e is sometimes used instead of u to designate uncertainty.

NOTE 2 Uncertainty of measurement comprises, in general, many components. Some of these components may be estimated on the basis of the statistical distribution of the results of series of measurements and can be characterized by experimental standard deviations. Estimates of other components can only be based on experience or other information.

6.30.021
random uncertainty
$U_r( )$
component of uncertainty associated with a random error

NOTE 1 Its effect on the mean value can be reduced by taking many measurements.

NOTE 2 The symbol e is sometimes used instead of U to designate uncertainty.

6.30.022
systematic uncertainty
$U_s( )$
component of uncertainty associated with a systematic error

NOTE 1 Its effect cannot be reduced by taking many measurements.

NOTE 2 The symbol e is sometimes used instead of U to designate uncertainty.

6.30.025
confidence level
probability that the true value will lie between the specified confidence limits, assuming negligible systematic error

NOTE This is generally expressed as a percentage, e.g. 95 %.

6.30.026
confidence limits
lower and upper limits within which the true value is expected to lie with a specified probability, assuming negligible systematic error

6.30.027
acceptable limits
limits within which the result of a measurement is acceptable relative to the true value or other specified value at a stated level of probability

6.30.030
true value
value consistent with the definition of a given particular quantity

NOTE 1 This is a value that would be obtained by a perfect measurement.

NOTE 2 True values are by nature indeterminate.

NOTE 3 Although VIM recommends the indefinite article "a", rather than the definite article "the" in conjunction with "true value" because there may be many values consistent with the definition of a given particular quantity, it is widely in use in the petroleum industry to speak of "the true value".

[Adapted from VIM 1993:1-19].

6.30.031
conventional true value
value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose

NOTE 1 "Conventional true value" is sometimes called assigned value, best estimate of the value, conventional value or reference value. "Reference value", in this sense, should not be confused with "reference value" in the sense used in the note to 6.60.010.

NOTE 2 Frequently, a number of results of measurements of a quantity are used to establish a conventional true value.

[VIM 1993:1-20]

6.30.032
outlier test
specified named statistical approach to the determination of outlier status of a single result amongst others

NOTE The Hawkins test is specified in ISO 4259 for the assessment of outliers in the petroleum industry, but the Grubbs test and Dixon test are widely used in flow-metering applications.

6.30.035
correlation coefficient
indication of the closeness of the curve fit to all points: normally a value of 0 indicates no fit while a value of 1 indicates that all the points fit the equation

6.30.040
degrees of freedom
quantity of information, expressed as the number of independent observations, on which a variance estimate is based

NOTE The degrees of freedom are the number of observations less the number of constants calculated from the data.

6.30.045
variance
mean of the squares of the deviation of a random variable from its mean, estimated by the mean square

6.30.050
standard deviation
measure of the dispersion of a series of results around their mean, equal to the positive square root of the variance and estimated by the positive square root of the mean square

6.30.051
experimental standard deviation
for a series of n measurements of the same measurand, the quantity, s, characterizing the dispersion of the results and given by the formula

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

where

x_i is the result of the i^{th} measurement;

$\bar{x}$ is the arithmetic mean of the n results considered

NOTE Considering the series of n values as a sample of a distribution, $\bar{x}$ is an unbiased estimate of the mean μ, and s^2 is an unbiased estimate of the variance σ^2, of that distribution.

6.30.052
experimental standard deviation of the mean
estimate of the standard deviation of the arithmetic mean with respect to the mean of the overall population, given by the formula

$$s(\bar{x}) = \frac{s}{\sqrt{n}}$$

NOTE The experimental standard deviation of the mean is sometimes incorrectly called standard error of the mean.

6.30.053
pooled standard deviation
estimate of the standard deviation of the meter factor which is obtained from m sets of n proving runs using the equation:

$s(x)$ pooled =

$$\sqrt{\frac{\sum(x_i - \bar{x}_1)^2 + \sum(x_i - \bar{x}_2)^2 + \ldots + \sum(x_i - \bar{x}_m)^2}{n - m}}$$

where

x_i is the i^{th} reading of any set;

$\bar{x}_1, \bar{x}_2, \bar{x}_3, \ldots, \bar{x}_m$ are the mean values of each set

6.30.055
distribution
frequency distribution which has a scatter of single measurements about the mean

6.30.056
normal distribution
distribution in which the relative probability of a variable taking a value x, where x may have either a positive or negative value, is

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left[\frac{-(x-\mu)^2}{2\sigma^2}\right]$$

where

μ is the mean;

σ is the standard deviation

6.30.057
gaussian distribution
cf. **normal distribution** (6.30.056)

6.30.058
Poisson modified distribution
distribution in which the relative probability of a variable taking a value x, where x has only a positive value, is given by the series

$$\left[\frac{c}{c+1}\right]^p \left[1, \frac{p}{(c+1)}, \frac{p(p+1)}{2!(c+1)^2}, \frac{p(p+1)(p+2)}{3!(c+1)^3}, \frac{p(p+1)(p+2)(p+3)}{4!(c+1)^4}, \ldots\right]$$

where

$$x = \frac{p}{c}$$

p and c are constants

6.30.059
Student's distribution
distribution of the deviations of the mean values of random samples of n values from a normal distribution with mean μ expressed as a proportion of the sample standard deviation

NOTE It is used to set the confidence limits of the population mean, in particular in cases where the mean has been estimated from small samples. The value of t is obtained from tables giving the number of degrees of freedom and the confidence level according to the equation:

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

where

μ is the unknown population mean;

$\bar{x}$ is the sample mean;

n is the size;

s is the sample standard deviation.

In practice, the t-distribution values given in published tables are usually for $(n-1)$ degrees of freedom for a two-sided probability of either 95 % or 99 %.

6.30.060
Student's t
cf. **Student's distribution** (6.30.059)

6.30.061
frequency distribution
cf. **distribution** (6.30.055)

6.30.062
skewed distribution
frequency distribution which is not symmetrical about its mean value

6.30.100
acceptable quality level
maximum per cent defective (or the maximum number of defects per hundred units) that, for purposes of sampling inspection, can be considered satisfactory as a process average

6.30.150
extrapolation
process of obtaining the value of a function corresponding to a value of the argument greater or less than the extreme values given

6.30.151
interpolation
process of obtaining the value of a function corresponding to a value of the argument intermediate between those given

6.30.152
sub-tabulation
process of interpolation used to obtain the values of the function corresponding to regular fractional intervals between given values of the argument

6.30.160
discrimination
discrimination threshold
largest change in a stimulus that produces no detectable change in the response of a measuring instrument, the change in the stimulus taking place slowly and monotonically

[VIM 1993:5-11]

6.30.200
in transit difference
difference between the total calculated volume immediately after a loading and the total calculated volume immediately before discharge

6.30.201
outturn quantity
quantity of oil, discharged by a vessel, usually determined by measurement on shore and expressed in terms of net standard volume.

6.30.202
outturn loss/gain
difference, in net standard volume, between the quantity shown on the bill of lading and the quantity shown on the outturn certificate

NOTE It may be expressed as a volume or a percentage of the bill of lading quantity.

6.30.203
vessel-shore difference
difference between the total calculated volume recorded by the vessel corrected for OBQ or ROB as appropriate, and the total calculated volume recorded by the shore

6.30.210
vessel experience factor
mean value of the vessel load ratios (VLR) or vessel discharge ratios (VDR) obtained using a set of qualifying voyages

NOTE 1 The number of such qualifying voyages is normally a minimum of five

NOTE 2 Depending on the determination, it is expressed as VEFL (VEF on loading) or VEFD (VEF on discharging).

6.30.211
vessel load ratio
ratio of the total calculated volume measured on board a vessel immediately after loading less the OBQ to the total calculated volume measured by the loading terminal

6.30.212
vessel discharge ratio
ratio of the total calculated volume measured on board a vessel immediately before discharge less the ROB to the total calculated volume measured by the receiving terminal

6.30.215
volume correction factor
factor for correcting oil volumes to a standard reference temperature

6.30.216
mass conversion factor
factor for converting mass to apparent mass-in-air

cf. table 56 of ISO 91-1[1)]

NOTE The acronym WCF is generally used rather than the full term.

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1) ISO 91-1:1992, *Petroleum measurement tables — Part 1: Tables based on reference temperatures of* 15 °C *and* 60 °F.

6.30.250
measurand
quantity subjected to measurement

NOTE As appropriate, this may be the measured quantity or the quantity to be measured.

6.30.255
range
numerical difference between the extreme values of a number of consecutive measurements obtained over a short period of time for the same value of input

6.30.260
root-sum-square
method combining the estimates of standard deviation or uncertainty of a number of independent variables in which the squares of the variables are added and the square root taken of the sum

NOTE This method is sometimes termed summing in quadrature.

6.30.270
traceability
property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties

NOTE 1 The concept is often expressed by the adjective traceable.

NOTE 2 The unbroken chain of comparisons is called a traceability chain.

NOTE 3 (applicable only to the French text).

[VIM 1993:6-10]

6.30.280
argument
independent variable of a function

NOTE A table is prepared with value(s) of the independent variable(s), the value(s) extracted from the table being known as the dependent value(s).

6.40 Sampling

6.40.001
sample
portion taken from a material and representative of the material at the point of sampling

6.40.005
all levels sample
sample obtained with an apparatus which fills as it passes through the total liquid height in one direction

NOTE The container should be filled to 75 % or 80 % of its capacity.

6.40.010
top sample
spot sample obtained 150 mm below the top surface of the liquid

6.40.011
upper sample
sample taken at a level of one-sixth of the depth of liquid below the top surface

6.40.012
middle sample
sample taken at a level of one-half of the depth of liquid below the top surface

6.40.013
bottom sample
spot sample taken from the material at the bottom surface (floor) of a tank or container

6.40.014
lower sample
sample taken at a level of five-sixths of the depth of liquid below the top surface

6.40.015
skim sample
surface sample
sample taken from the surface of the liquid

6.40.020
composite sample
sample obtained by combining a number of spot samples in defined proportions so as to obtain a sample representative of the bulk of the material

NOTE The usual types of composite sample are obtained by combining samples in accordance with one of the following:

a) upper, middle and lower samples in equal proportions;

b) upper, middle and suction-level samples in equal proportions;

c) a series of spot samples from a non-homogeneous oil taken at more than three levels and blended in proportion to the quantities of oil represented;

d) individual sample from several tanks or ship's compartments proportional to the total quantity each sample represents;

e) a series of spot samples of equal volume obtained from a flowing pipeline taken at specified intervals.

6.40.025
spot sample
sample taken at a specific location in a tank or from a pipe at a specific time during a pumping operation

6.40.030
running sample
sample obtained by lowering a container from the top of the oil to the bottom and returning it to the top of the oil at a speed such that the container is about three-quarters full when withdrawn from the oil

6.40.035
representative sample
sample having its physical or chemical characteristics identical to the volumetric average characteristics of the total volume being sampled

6.40.040
suction-level sample
sample taken at the lowest level from which liquid hydrocarbon is pumped from the tank

6.40.045
fixed rate sample
time-proportional sample
sample taken from a pipeline during the whole period of transfer of a batch, composed of equal increments at uniform time intervals

6.40.050
flow-proportional sample
sample taken from a pipeline during the whole period of transfer of a batch, at a rate which is proportional to the rate of flow of the liquid through the pipeline at any instant

6.40.060
integrity of the sample
condition of being complete and unaltered, i.e. the sample being preserved with the same composition as when it was taken from the bulk of the liquid

6.40.065
sample conditioning
preparation of the laboratory sample for analysis, including all operations specified in the test method prior to the drawing of the test portion

6.40.066
sample handling
all operations following the completion of sampling to the receipt of the laboratory sample in the analysing laboratory

6.40.070
calculated sample volume
theoretical sample volume obtained by multiplying the sample grab volume by the number of grabs actually collected

6.40.071
grab
portion of liquid extracted from the pipe by a single actuation of the extracting device

NOTE The sum of all the portions results in a sample.

6.40.075
sample container
vessel used for the storage, transportation and preconditioning of the total quantity, or a proportion of the total quantity, of the sample for analytical work or for division into identical small sub-samples to be analysed

6.40.076
sample receiver
container connected to automatic sampling equipment in which the sample is collected during the sampling operation

6.40.077
sample size
volume of sample required to be drawn

6.40.080
percent defective
one hundred times the number of defective units of product contained in any given quantity of units of product divided by the total number of units of product, i.e.:

$$\text{per cent defective} = \frac{\text{number of defectives}}{\text{number of units inspected}} \times 100$$

6.40.100
sampling system

system capable of extracting a representative sample from the fluid flowing in a pipe

NOTE This system can be automatic or manual, continuous or intermittent.

6.40.101
automatic sampler
device for the extraction of a representative sample from a liquid flowing in a pipe

NOTE It includes the sampling probe, together with extraction and control equipment, it may also include a specialized sample receiver.

6.40.102
automatic sampling system
system of sampling that provides stream conditioning before the operation of an automatic sampler, and may provide sample conditioning

6.40.103
sampler performance factor
ratio between the accumulated sample volume and the calculated sample volume

6.40.104
sampling probe
device inserted into gas or liquid to be sampled from the transfer line or fitted to the transfer line for collecting a sample

6.40.105
continuous sampler
system for extracting liquid from a flowing stream which has a device which continuously withdraws liquid from the main pipeline in relation to flow rate, an intermediate sample receiver, and a means for controlling secondary withdrawal to a final sample receiver

6.40.106
continuous sampling
sampling in which the sample is drawn from the source continuously during the total transfer time

6.40.107
intermittent sampler
system for extracting liquid from a flowing stream, a sample receiver to contain the sample grabs taken from the stream, and a means for controlling the amount of sample taken by varying the sampling frequency or grab volume in relation to flowrate

6.40.108
stream conditioning
distribution and dispersion of the pipeline contents, upstream of the sampling location

6.40.110
isokinetic sampling
sampling in such a manner that the linear velocity of the liquid through the opening of the sampling probe is equal to the linear velocity of the liquid in the pipeline at the sampling location and is in the same direction as that of the bulk of the liquid in the pipeline approaching the sampling probe

6.40.120
sampling frequency
number of grabs taken in unit time

6.40.121
sampling interval
time between successive grabs

6.40.122
sampling location
cross-section of the pipe where the sampling probe is, or is proposed to be, located

6.40.123
sampling ratio
quantity of pipeline contents represented by one grab

NOTE It can be expressed as either the volume, in cubic metres per grab, or the equivalent length of pipeline, in metres per grab.

6.40.124
sampling line of liquefied natural gas
whole line provided to carry the sample to be analysed from the sample probe in the LNG transfer line to the gas sample container including any flexible or semi-rigid tubing

6.40.150
profile
set of samples taken simultaneously at several points across a diameter of the pipe

NOTE The term is also used to denote the series of sampling points themselves and the set of results obtained by analysis of the samples taken at these points.

6.40.151
profile average
average of the water concentration at each point in the same profile

NOTE Profiles with less than 1 % water are neglected.

6.40.152
overall mean
average of either the point averages or the profile averages

NOTE Note that the result is the same.

6.40.153
profile testing
technique for simultaneous sampling at several points across the diameter of a pipe

NOTE Terms used in connection with profile testing are as follows:

overall mean, point, point average, profile, profile average.

6.40.154
point
single sampling orifice in the profile

6.40.155
point average
average of the water concentration at the same point in all profiles

NOTE Points with less than 1 % water are neglected.

6.40.160
sample loop
bypass to the main pipeline being sampled, through which a representative portion of the total flow is circulated

6.50 Properties and instrumentation

6.50.010
thermowell
metal pocket which protrudes through the wall of a pipe or tank and holds the sensing element of a temperature-measuring device

6.50.011
automatic temperature-measuring system
system that automatically measures the temperature of a fluid on a continuous or semi-continuous basis

6.50.012
electrical averaging thermometer
thermometer that measures the average temperature of a volume of liquid in a tank or the temperature at selected intervals throughout its depth

6.50.013
electrical spot thermometer
thermometer that measures the temperature of a liquid at a particular point in a tank by electrical resistance

6.50.014
resistance thermometer
temperature-sensing element constructed from material whose electrical resistance changes with temperature in a predictable manner

6.50.015
temperature compensator
mechanism attached to a meter to correct for the effect of temperature on the measured volume, or an electronic device serving the same purpose

6.50.020
density meter
electronic instrument for measuring density

NOTE Applicable only to the French language.

6.50.021
continuous density meter
meter in which the material flows continuously through or around a transducer, generating a continuous density measurement

6.50.022
in-line density meter
density meter in which the transducer is located directly within the main line or vessel and measures continuously

NOTE No sampling system is required.

6.50.023
off-line density meter
density meter separate from the main line or vessel and usually situated in a laboratory

NOTE This requires a discrete sample to be drawn from the line/vessel for analysis.

6.50.024
on-line density meter
density meter operating on a sample of the fluid withdrawn continuously from a main line or vessel via a sampling system

6.50.025
density transducer
sensing component of a density meter

6.50.030
servo-mechanism
externally powered mechanism which is controlled by the detecting element

6.50.040
apparent mass in air
value obtained by weighing in air against standard masses without making correction for the effect of air buoyancy on either the standard masses or the object weighed

6.50.041
gross apparent mass-in-air of oil
mass which a GSV (6.99.041) of oil has when weighed in air

6.50.042
net apparent mass-in-air of oil
value that would be obtained by weighing the net standard volume of oil in air against standard masses without making correction for the effect of air buoyancy on either the standard masses or the object weighed

6.50.050
observed density
value required in order to enter tables 53A and 53B referred to in ISO 91-1[1)], determined with soda-lime glass apparatus at a test temperature which differs from the calibration temperature of the apparatus, no correction having been made for the thermal expansion or contraction of the glass

NOTE A correction factor for glass expansion may be required according to the type of equipment used to obtain the value.

6.50.051
orthobaric density
mass of the liquid occupying unit volume at a given temperature, the liquid being in equilibrium with its vapour

6.50.052
gross standard density of oil
mass per unit gross standard volume of oil (determined after homogenisation of the sample)

6.50.053
net standard density of oil
mass per unit net standard volume (NSV) of oil

6.50.054
in-tank vapour density
density of vapour in the ullage space of a tank at the observed conditions of temperature and pressure

6.50.060
density pressure coefficient
change in density of the fluid per unit pressure at a given pressure temperature

6.50.061
density temperature coefficient
change in density of the fluid per unit temperature at a given temperature and pressure

6.50.070
compressibility factor of gases
ratio of the real volume of a given mass of gas at a specified temperature and pressure to its volume under the same conditions calculated from the ideal gas law

6.50.071
compressibility factor of liquids
factor obtained from parameters of density and temperature and used with pressure data to calculate the pressure correction factor, C_{pl}, of a volume of liquid

6.50.075
ideal volume basis
volume calculated on the basis that the vapour behaves like an ideal gas

6.50.076
real volume basis
volume calculated on the basis that the vapour behaves like a super-compressible gas

6.50.080
gross specific energy
quantity of heat released when a combustible material is burned completely in dry air, the water vapour produced being condensed to liquid in equilibrium with its own vapour under the specified standard conditions, and the latent heat of condensation being included in the heat content

NOTE 1 The term used is "specific energy". Historical obsolete synonyms are "heat of combustion" and "calorific value".

NOTE 2 Specific energy may be expressed on a mass or volume basis, e.g. in megajoules per kilogram (MJ/kg) or gigajoules per cubic metre (GJ/m^3).

6.50.081
net specific energy
quality of heat released when a combustible material is burned completely in dry air, and the water vapour produced is assumed to remain in the vapour phase

NOTE 1 The term used is "specific energy". Historical obsolete synonyms are "heat of combustion" and "calorific value".

NOTE 2 Specific energy may be expressed on a mass or volume basis, e.g. in megajoules per kilogram (MJ/kg) or gigajoules per cubic metre (GJ/m^3).

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1) ISO 91-1:1992, *Petroleum measurement tables — Part 1: Tables based on reference temperatures of* 15 °C *and* 60 °F.

6.50.090
digital signal
representation of the value of a variable in the form of a series of individually distinct pulses or voltage states

6.50.095
resolution of a displaying device
smallest difference between indications of a displaying device that can be meaningfully distinguished

NOTE 1 For a digital displaying device, this is the change in the indication when the least significant digit changes by one step.

NOTE 2 This concept also applies also to a recording device.

[VIM 1993:5-12]

6.60 Calibration and standards

6.60.010
reference conditions
conditions of use prescribed for testing the performance of a measuring instrument or for intercomparison of results of measurements

NOTE The reference conditions generally include reference values or reference ranges for the influence quantities affecting the measuring instrument.

[VIM 1993:5-7]

6.60.011
standard reference conditions
base conditions
conditions of temperature and pressure to which measurements are referred for standardization

NOTE 1 For the petroleum industry, these are usually 15 °C or 20 °C and 101,325 kPa.

NOTE 2 There is also in OIML R 117 another definition which is parallel and not contradictory.

6.60.015
standard scale
measure to be used for accuracy test of the level gauge

6.60.016
reference standard
standard, generally having the highest metrological quality available at a given location or in a given organization, from which measurements are derived

[VIM 1993:6-6]

NOTE In some countries it may be a legal requirement or industry practice to use the following definition: "volumetric standard, with traceability to national standards, used in the field for the proving of a meter and forming the standard against which the performance of the meter is expressed".

6.60.017
secondary standard
standard whose value is assigned by comparison with a primary standard of the same parameter

NOTE Adapted from VIM 1993:6.5.

6.60.020
dry measure
volumetric contents measure that is calibrated with the internal surface free from liquid (i.e. no clingage)

6.60.021
wet measure
volumetric measure that is first wetted and drained, leaving internal clingage, before receiving or delivering water for the calibration of a measuring device

6.60.022
wetted area
portion of the internal surface of a volumetric tank which has been in contact with the liquid during the proving operation

6.60.023
primary measure
volumetric standard, traceable to national standards and capable of a high degree of resolution and accuracy, that is calibrated gravimetrically using water

6.60.024
secondary measure
volumetric standard that is calibrated by means of a primary measure

NOTE Petroleum industry practice may lead to the use of another secondary measure, characterized by a smaller "intrinsic" uncertainty, to make this calibration.

6.60.030
calibration
proving
set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards

NOTE 1 The result of a calibration permits either the assignment of values of measurands to the indications or the determination of corrections with respect to indications.

NOTE 2 A calibration may also determine other metrological properties such as the effect of influence quantities.

NOTE 3 The result of a calibration may be recorded in a document, sometimes called a calibration certificate or a calibration report.

[VIM 1993:6.11]

6.60.035
drain time
draining time
time required to drain a primary or secondary volumetric measure according to its calibration certificate

6.60.040
water-draw
technique for calibrating a proving tank or pipe prover by displacing water from the prover into a primary or secondary measure

6.60.050
automatic pipette
glass or metal primary measuring instrument designed to deliver automatically a precise quantity of water and typically used to calibrate secondary measures

6.60.055
proving tank
volumetric standard usually consisting of a cylindrical section with a conical top and bottom and a cylindrical neck calibrated either in units of volume or in steps corresponding to fractions of a percentage of the tank volume

6.60.060
transfer standard
standard used as an intermediary to compare standards

NOTE The term transfer device should be used when the intermediary is not a standard.

[VIM 1993:6-8]

6.60.065
seraphin
fenestrated neck can
primary or secondary measure having an elongated narrow neck which has a visible liquid level and scale graduated in increments of volume

NOTE The method of calibration should be stated on the calibration certificate.

6.60.070
correction factor
numerical factor by which the uncorrected result of a measurement is multiplied to compensate for systematic error

NOTE Since the systematic error cannot be known perfectly, the compensation cannot be complete.

6.99 Acronyms

6.99.010	AQL	acceptable quality level	6.30.100
6.99.040	GOV	gross observed volume	6.10.100
6.99.041	GSV	gross standard volume	6.10.103
6.99.050	HTG	hydrostatic tank gauging	6.10.113
6.99.060	NOV	net observed volume	6.10.101
6.99.061	NSV	net standard volume	6.10.104
6.99.070	OBQ	on board quantity	6.10.410
6.99.071	ROB	quantity remaining on board	6.10.411
6.99.090	RTD	resistance thermometer	6.50.014
6.99.100	TCV	total calculated volume	6.10.301
6.99.101	TOV	total observed volume	6.10.302
6.99.102	TSV	total standard volume	6.10.304
6.99.110	VCF	volume correction factor	6.30.215
6.99.111	WCF	mass conversion factor	6.30.216
6.99.120	VDR	vessel discharge ratio	6.30.212
6.99.121	VLR	vessel load ratio	6.30.211
6.99.130	VEF	vessel experience factor	6.30.210
6.99.131	VEFD	vessel experience factor on discharging	6.30.210
6.99.132	VEFL	vessel experience factor on loading	6.30.210

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